Factors Affecting Outcome of CLI Procedures

Dr Kiang Hiong TAY (MBBS, FRCR, FAMS, FSIR)
Singapore General Hospital
Duke NUS Graduate Medical School
Yong Loo Lin School of Medicine, National University of Singapore
Disclosure

Nil relevant to this presentation
Factors Affecting CLI Outcomes

- Demographics
- Co morbidities
- Functional status
- Extent of tissue loss
- Infection
- Biochemical markers

- Pattern of PAD disease
- Revascularisation strategy, tools, devices & techniques
- Wound care
- Etc
Angiographic Endpoints in CLI Revascularisation

- Single straight line flow to the foot
- Direct in line flow to dorsalis pedis or plantar artery preferred over indirect flow via peroneal artery
- Open as many lines of flow as possible to the foot
- Need to establish in line flow to the affected angiosome
- Establish flow (direct or indirect) to affected angiosome
# Direct vs Indirect Angiosome Revascularisation

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Series</th>
<th>Clinical success without AM</th>
<th>Clinical success with AM</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neville</td>
<td>2009</td>
<td>Surg</td>
<td>62%</td>
<td>91%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Varela</td>
<td>2010</td>
<td>Surg+Endovasc</td>
<td>73%</td>
<td>92%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Iida</td>
<td>2010</td>
<td>Endovasc</td>
<td>69%</td>
<td>86%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>O’Brien-Irr</td>
<td>2010</td>
<td>Surg</td>
<td>61%</td>
<td>82%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Alexandrescu</td>
<td>2011</td>
<td>Endovasc</td>
<td>67%</td>
<td>86%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Iida</td>
<td>2011</td>
<td>Endovasc</td>
<td>68%</td>
<td>82%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Blanes</td>
<td>2011</td>
<td>Endovasc</td>
<td>73%</td>
<td>79%</td>
<td>P&gt;0.05</td>
</tr>
<tr>
<td>Deguchi</td>
<td>2010</td>
<td>Surg</td>
<td>72%</td>
<td>73%</td>
<td>P&gt;0.05</td>
</tr>
</tbody>
</table>

*Alexandrescu et al. J Cardiovasc Surg 2012; 53:3-12*
Angiosome Directed Angioplasty

- Not always possible
  - Possible in ~50% of cases
- Target pedal arteries may be occluded
- Bigger wounds often involve more than 1 angiosome
- Below the ankle angioplasty technically demanding esp CTOs
  - Can worsen situation due to dissections and vasospasms
Angiosome Concept: Hype or Help?

- Evidence base is not strong
  - Case series, mainly retrospective, no RCTs
- Direct revascularisation not always necessary
- More to wound healing than just revascularisation
  - Infection, diabetic control, neuropathy, off loading etc
What should be the angiographic end point for BTK intervention?

- Retrospective review of patients who presented with CLI for angioplasty
  - January 2009 to December 2011
  - 693 limbs in 511 patients
- Correlate completion angio with limb salvage

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>67 ± 11 yrs</td>
<td><strong>ESRF</strong></td>
</tr>
<tr>
<td><strong>Diabetes Mellitus</strong></td>
<td>92%</td>
<td><strong>Hx of CAD</strong></td>
</tr>
<tr>
<td><strong>Hyperlipidemia</strong></td>
<td>64%</td>
<td><strong>Hx of CVA</strong></td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
<td>83%</td>
<td><strong>Rutherford 5, 6</strong></td>
</tr>
</tbody>
</table>
Angiographic Predictors of Limb Salvage

- Number of crural vessel runoff (0, 1, 2, 3 vessels)
- Angiosome directed angioplasty (Direct versus Indirect)
- Plantar arch integrity (Complete, partial, absent)
Limb Salvage vs Crural Vessel Runoff

0 vs 1 vessel, \( p = 0.005 \)
1 vs 2 vessel, \( p = 0.444 \)
2 vs 3 vessel, \( p = 0.548 \)
Limb Salvage vs Plantar Arch Integrity

CPA vs. PPA, p=<0.001
PPA vs. APA, p=<0.001
Limb Salvage vs Angiosome Directed Angioplasty

Direct group

Indirect group

P=0.001
Limb Salvage, Angiosome Concept and Plantar Arch Integrity

- Complete plantar arch, \( p = 0.285 \)
- Partial/Absent plantar arch, \( p = 0.021 \)
## Multi-variate Analysis

### Multivariate analysis for predictors of improved limb salvage rate

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hazard Ratio (95% Confidence Interval)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.988 (.972 - 1.004)</td>
<td>.148</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1.963 (.795 - 4.849)</td>
<td>.144</td>
</tr>
<tr>
<td>End stage renal disease</td>
<td>1.326 (.942 - 1.867)</td>
<td>.105</td>
</tr>
<tr>
<td>History of ischemic heart disease</td>
<td>1.287 (.925 - 1.79)</td>
<td>.134</td>
</tr>
<tr>
<td>PTA disease</td>
<td>.825 (.47 - 1.446)</td>
<td>.501</td>
</tr>
<tr>
<td><strong>Number of crural vessel runoff</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 vessel vs. 1 vessel</td>
<td>.497 (.271 - .909)</td>
<td>.023</td>
</tr>
<tr>
<td>1 vessel vs. 2 vessel</td>
<td>.761 (.477 - 1.216)</td>
<td>.254</td>
</tr>
<tr>
<td>2 vessel vs. 3 vessel</td>
<td>.733 (.344 - 1.562)</td>
<td>.421</td>
</tr>
<tr>
<td>Direct vs. Indirect angioplasty</td>
<td>.699 (.419 - 1.166)</td>
<td>.170</td>
</tr>
<tr>
<td><strong>Plantar arch integrity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent arch vs. partial arch</td>
<td>.364 (.227 - .585)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Partial arch vs. complete arch</td>
<td>.332 (.184 - .599)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
Discussion

• At least 1 vessel run off is required for limb salvage.
• Recanalising 2 or 3 crural vessels does not significantly improve limb salvage compared to 1 vessel run off.
• Plantar arch integrity is a strong predictor of successful limb salvage.
• Study limitation
  – Many other factors that could affect limb salvage (e.g. wound care/infection, diabetic control) were not investigated in this study
Discussion

• For complete plantar arch, angiosome directed angioplasty is not critical for limb salvage

• For partial or absent plantar arch, direct angiososomal angioplasty has superior limb salvage compared to indirect angiososomal angioplasty
  – If direct angiosomal angioplasty is not possible, reconstruction of the plantar arch may be a better strategy compared to opening more crural vessels
Courtesy of Dr. Roberto Ferraresi
Discussion

• However, there are risks of worsening ischemia associated with plantar arch reconstruction:
  – Vasospasm and dissection
  – Stripping of side branches from subintimal angioplasty

• Further studies warranted to identify patients that may benefit from arch reconstruction
Angiographic end points for CLI Revascularisation

• If plantar arch is complete, 1 vessel runoff is sufficient

• If plantar arch is not complete
  – direct angiosomal angioplasty if possible
  – Plantar arch reconstruction in selected patients
Thank you for your attention!
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